ELECTROACTIVE POLYMER MODIFIED ELECTRODE MATERIALS PREPARED IN DEEP EUTECTIC SOLVENTS AND APPLICATION AS SENSOR PLATFORMS

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Deep eutectic solvents (DES) are interesting alternatives to room temperature ionic liquids and to non-aqueous solvents. Applications are in many fields, such as polymer science, metal electrodeposition and nanomaterials, with a few recent applications in sensors.[1,2] DES synthesis is simple and normally done by direct mixing of two solid non-toxic components with some heating, the eutectic being a viscous liquid. Eutectic formation usually occurs due to strong hydrogen bond interactions between a hydrogen bond acceptor, such as choline chloride, and a hydrogen bond donor such as urea, ethylene glycol or glycerol (i.e. amine or hydroxyl groups), the resulting DES being designated as reline, ethaline and glyceline, respectively.

We have prepared electroactive polymer-modified electrodes by electropolymerisation in these DES under varying experimental conditions and investigating their properties in order to tune the nanostructure and surface morphology for sensing applications. Usually, a second hydrogen bond donor has been added in the form of a small percentage of a strong acid. The first studies involved formation of films of the conjugated polymer poly(3,4-ethylenedioxythiophene), where distinct responses depending on the DES used.

Films of nanostructured redox polymers on electrodes, obtained by electropolymerisation of phenazine or triarylmethane monomers,[3] have been prepared in DES, normally ethaline. Variation of the strong acid anion can have interesting effects. Polymers include poly(methylene blue),[4] poly(neutral red), poly(brilliant cresyl blue) and poly(brilliant green). Modified electrode platforms have been constructed and characterised electrochemically and by surface analysis. The enhanced characteristics of the sensors and biosensors for key analytes such as ascorbate and acetaminophen and of species leading to enzyme inhibition are superior to those of the same sensor architectures containing polymer films formed in aqueous solution.

References
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